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**„Verfahren zur Behandlung von legierten kohlenstoffhaltigen Eisenschmelzen zur Herstellung von Stahl“**

Auf den ersten schriftlichen Bescheid gemäß Regel 66 PCT vom 22.12.2003:

I.

In diesem Bescheid wird auf die englischen abstracts sowie die japanischen Vollschriften der folgenden Dokumente

D1 JP-A 08 085815

D2 JP-A-09 087 720

D3 JP-A-07 216 429

verwiesen.

*Fließf. v. H. Nocke, EPAT  
am 1.4.04.  
Wir senden Ihnen D1+D2  
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II.

Gegenstand des angemeldeten Verfahrens ist nach den Merkmalen des Anspruchs 1 nicht nur der Verzicht auf ein Zwischenabschlacken, sondern die Durchführung von mehreren hintereinander ablaufenden Entkohlungsprozessen in der Weise, dass die Schlacke zunehmend mit Metalloxiden, insbesondere Chromoxiden, gesättigt wird, wodurch eine Verschlackung dieser Metalloxide zunehmend entgegengewirkt wird. Ein solches Ausnutzen des Sättigungsgrades und damit des Umstandes, dass eine zunehmende Konzentration an Metalloxiden in der Schlacke eine Verschlackung mehr und mehr entgegengewirkt, ist aus den Dokumenten D1 bis D3 nicht bekannt. Erst dann, wenn der Sättigungsgrad oder ein annähernder Sättigungsgrad der Schlacke erreicht ist, wird die Schlacke reduziert und dann abgeschlackt.

Die JP-A 08 085815 (D1) beschäftigt sich mit der Herstellung von chromhaltigen Stählen. Aus Absatz [0010] der englischen Übersetzung der JP-A-08 085815 geht zudem hervor, dass eine Schlacke, bei der ein Reduktionsprozess durchgeführt worden ist, abgezogen wird (...*Subsequently, rough molten steel is newly \*\*\*\*(ed) by \*\*, reduction processing by rough molten steel of a slag made to remain in a furnace by \*\* is performed, and only a slag by which reduction processing was carried out by \*\* is discharged....*)

Es ist an keiner Stelle der JP-A 08 085815 mit irgendeinem Wort erwähnt, mehrere Entkohlungsprozesse mit „der gleichen Schlacke“ durchzuführen, wobei diese mit Metalloxiden zunehmend angereichert wird, wodurch einer Verschlackung zunehmend entgegengewirkt wird.

Dies ist auch nicht aus den beiden anderen Dokumenten D2 bzw. D3 offenbart.

Aus dem englischen abstract der JP-A-09 087 720 (D2) ist bekannt, dass bei einem Verfahren zur Entkohlung von chromhaltigem Stahl chromhaltige Schlacke im Ofen für den sich anschließenden Entkohlungsprozess verbleibt. Sowohl aus dem abstract als auch der englischen Computer-Übersetzung geht an keiner Stelle hervor, die Schlacke ohne Zwischenentschlacken so lange für mehrere Entkohlungsprozesse zu verwenden, so dass sich die Schlacke zunehmend an Cr<sub>2</sub>O<sub>3</sub> anreichert und damit einer Verschlackung entgegenwirkt. Gegenstand der JP-A- 09 087 720 ist die Einstellung der Mengen der Schlackebildner CaO und SiO<sub>2</sub> sowie einer bestimmten Schlacke-Basizität.

Schließlich ist der Gegenstand der Anmeldung auch nicht durch den englischen abstract der JP-A-07 216 429 bzw. der Vollschrift (D3) neuheitsschädlich vorweggenommen oder nahegelegt. Aus dem abstract geht hervor, dass chromhaltige Schlacke, die in einem vorherigen Entkohlungsprozess entstanden ist, im Behandlungsgefäß verbleiben soll. Durch Zugabe von kohlenstoffhaltigem Material und Durchführung eines Entkohlungsprozesses sinkt der Chrom-Gehalt in der Schlacke auf <= 20 Gewichts-%. Die Temperatur der entkohlten Schlacke soll auf 1.400-1.700°C gehalten werden, während geschmolzenes Eisen einer nachfolgenden Charge chargiert wird. Nachdem der Chrom-Gehalt der Schlacke reduziert ist, wird die Schlacke, aus der der Chrom-Gehalt wiedergewonnen wurde, abgezogen. Dieses Zwischenabschlacken ist auch in der englischen Übersetzung unter Absatz [0008] erwähnt.

III.

Nach alledem ist das beanspruchte Verfahren nach Anspruch 1 weder neuheitsschädlich vorweggenommen nach nahegelegt. Auch keinem der Dokumente D1 bis D3 ist offenbart, ohne Zwischenabschlacken eine Schlacke mit Metalloxiden, insbesondere Chromoxiden, zu einem solchen Sättigungsgrad anzureichern, dass einer Verschlackung zunehmend entgegengewirkt wird. Die Behandlung findet ohne Zwischenabschlacken der Schlacke statt, die sich über mehrere Chargen an Roheisen und mehreren Abstichen an Stahlschmelze ansammelt. Hierbei ist vorteilhaft, dass pro Entkohlungsprozess immer weniger an teurem Chromoxid verschlackt. Dieser Gedanke ist überraschend und in keinem der bekannten Dokumente irgendwie vorweggenommen oder nur angedeutet.

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**Anlage:**

Auszüge aus englischen Computerübersetzungen der Dokumente D1 bis D3

## DETAILED DESCRIPTION

### [Detailed Description of the Invention]

[0001]

[Industrial Application] It is related with the manufacture method of the stainless steel rough molten steel characterized by carrying out the waste of the slag collected [chromium], and carrying out decarbonization refinement at the same furnace successively after this invention returns a part for the chrome oxide in the decarbonization slag generated by front charge in refinement with a converter mold reaction container with the molten iron of degree charge.

[0002]

[Description of the Prior Art] There is \*\* chromium melted iron ingot with the electric furnace as a raw material for refining the molten steel containing chromium using the shaft furnace molten iron dephosphorized and desulfurized by refinement furnace outside, the \*\* chromium molten iron generated by melting reduction of a chrome ore, and a stainless steel scrap. These raw materials are falling to the carbon concentration which fulfills a quality-of-the-material property by carrying out \*\*\*\* decarbonization refinement by the top-blown rotary converter, the \*\*\*\*\* converter, the raised bottom \*\*\*\* converter, and AOD, and carrying out \*\*\*\* decarbonization refinement at VOD or a vacuum-refining furnace called RH-alumnus further depending on the case.

[0003] However, in these refinement furnaces, carrying out reduction recovery of the chrome oxide generated during \*\*\*\* decarbonization at the time of \*\*\*\* termination using reducing agents, such as Fe-Si, is performed widely. Since this reducing agent has the high price, the attempt for which chromic-acid-ization in \*\*\*\* is reduced as much as possible is made. For example, at JP,61-3815,A or JP,61-19716,A, the refinement method which controlled oxidation of chromium is indicated by controlling the oxygen transmission speed and the stirring force under blowing proper. However, even if it uses these methods, the amount of the reducing agent used cannot be made into zero.

[0004] On the other hand, with the plain steel which does not contain chromium, the method of using the slag generated by decarbonization as a dephosphorization agent of the molten iron removal treatment of phosphorus performed with a converter mold reaction container is shown by JP,63-195209,A. however, the oxide generated by decarbonization refinement of high chrome steel to being effective as a dephosphorization agent since FeO generated by decarbonization refinement of plain steel is easily returned with the carbon in molten iron even if it is low temperature -- Cr 2O3 of difficulty reducibility A sake it is -- Cr 2O3 In the state of low temperature, even if it was molten iron of the concentration near carbon saturation, it could not return, but there was a problem that it could not use as a dephosphorization agent. Moreover, since the so-called bumping in which the generating reaction of explosive CO gas arises and insertion molten iron disperses at the time of molten iron insertion since reactivity is good happened, the high slag of FeO had a problem on safety.

[0005] By the way, when dephosphorization is carried out by refinement furnace outside and it aims only at reduction of a chromic-acid ghost, it is equivalent to the melting reduction technology in the converter mold reaction container of a chromic-acid ghost, and such technology is shown by JP,60-9815,A and JP,1-215913,A. This method adds a chrome ore and charcoal material continuously under the conditions controlled to the specific slag presentation. However, in order [that the chromic-acid ghost concentration contained in a slag is very low as compared with decarbonization slag, and the fluidity of a slag is high and in order to use a lot of charcoal material for reduction], Molten iron had the feature that carbon runs at speed also with the quick reduction by near and molten iron to saturated concentration, and reduction on the conditions in which it is the carbon partial saturation in the slag condition which does not have a fluidity highly [chromic-acid ghost concentration], and the charcoal material in a slag does not exist had the problem that it could not do, with this technology.

[0006] Moreover, as the recovery use method of the chromium from \*\* chrome steel slag, the cooling solidification of the remnants of \*\* chrome steel is carried out, and the method of adding solid-state remnants at the time of blowing of other charges for \*\* chrome steel in a converter is shown by JP,53-119210,A. However, since the cooling solidification of the remnants of \*\* chrome steel is carried out, although bumping at the time of molten iron insertion is avoidable by this method In order for a reaction to hardly have advanced at the time of low temperature, but to have advanced the reduction reaction and to have collected parts for the chromium of the amount of aims, molten iron temperature

and slag temperature needed to be raised to a certain amount of temperature, and there was a problem of having originated in this and causing extension of remarkable refinement time amount, i.e., the fall of productivity.

[0007]

[Problem(s) to be Solved by the Invention] The problem that this invention cannot make zero the expensive amount of the reducing agent used with the technology indicated by JP,61-3815,A and JP,61-19716,A, With the technology currently indicated by JP,63-195209,A The oxide which the problem on the safety of bumping is upwards, and is generated by decarbonization refinement of high chrome steel Cr 2O3 of difficulty reducibility it is -- a sake -- molten iron -- easy -- returning -- not having -- as a dephosphorization agent -- it cannot use -- \*\* -- saying -- a problem -- and by the method currently indicated by JP,60-9815,A or JP,1-215913,A Chromic-acid ghost concentration by the carbon partial saturation in the slag condition which does not have a fluidity highly And the problem that reduction on the conditions to which charcoal material does not exist in a slag cannot be performed, By the method furthermore shown by JP,53-119210,A, the problem of causing extension of remarkable blowing time amount is solved, and it aims at offering the manufacture method of stainless steel rough molten steel using efficient decarbonization slag.

[0008]

[Means for Solving the Problem] A place which this invention solves said technical problem and is made into the summary By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr 2O3) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge with a temperature of 1500 degrees C or less is inserted in. After carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag, the waste of the slag collected [ chromium ] is carried out, and it is in a manufacture method of stainless steel rough molten steel using decarbonization slag characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly.

[0009] When long duration is taken to insert in molten iron of degree charge here and temperature of decarbonization slag falls to less than 1400 degrees C, it is effective by blowing a top after charcoal material addition, performing \*\*\*\*, and burning charcoal material to hold temperature of decarbonization slag before molten iron insertion at 1400-1700 degrees C. Moreover, while making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO2. [ whether 1.0-3.0, and MgO are 15% or less and ] Or CaO/SiO2 3.0-4.0, and aluminum 2O3 5 - 20% and MgO being 15% or less and \*\*\*\* temperature up refinement are in a condition which made carbon concentration in molten steel 1% or more. By carrying out controlling molten steel temperature at 1500-1700 degrees C, the reduction recovery of the part for chromium in decarbonization slag can be carried out much more efficiently.

[0010] Furthermore, if the aforementioned slag heat retaining temperature is made into 1400-1500 degrees C, an erosion of refractories can be controlled completely, is stabilized more and can attain sufficient effect.

[0011]

[Function] The production process of this invention is shown in drawing 1 . the reduction production process according [ a production process 1 ] to the charcoal material addition after tapping -- a production process 2 -- the insertion production process to the converter of dephosphorization / desulfurization molten iron -- a production process 3 -- a temperature-programmed-reduction production process -- in a production process 4, a production process 5 shows the dissolution production process of decarbonization and a ferrochrome alloy, and a production process 6 shows a tapping production process for a middle waste production process. For the slag after charcoal material reduction termination, and 3, as for a converter and 5, in drawing 1 , melted iron (molten iron thru/or molten steel) and 4 are [ the decarbonization slag which generated 1 by front charge and 2 / the slag collected / chromium / and 6 ] decarbonization slag. Thus, by adding charcoal material, performing the furnace swing of multiple times, leaving in a converter the decarbonization slag generated by decarbonization of front charge, and mixing charcoal material with decarbonization slag The

temperature of decarbonization slag in the condition of having held at 1400-1700 degrees C, by reducing the chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag to 20% or less, and blowing oxygen a top, carrying out it, and burning charcoal material The molten iron of degree charge of 1500 degrees C or less is inserted in, and while blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned. Then, after tilting a converter and carrying out the waste of this chromium recovery part slag, while uprighting a furnace and being decarbonized by blowing oxygen a top and carrying out it, it is the production process which carries out addition dissolution of the ferrochrome alloy, and manufactures stainless steel rough molten steel. In addition, the converter mold reaction container as used in the field of this invention has pointed out the reaction container which makes a refinement means blowing by the oxidizing gas represented by a top-blown rotary converter and the raised bottom \*\*\*\* converter.

[0012] this invention persons are Cr<sub>2</sub>O<sub>3</sub>. As a result of considering wholeheartedly the reaction of a content slag and carbon saturation melted iron, it is Cr<sub>2</sub>O<sub>3</sub>. Even if the temperature of a content slag is 1400 degrees C or more and it has a fluidity, it is Cr<sub>2</sub>O<sub>3</sub>. By reducing concentration to 20% or less, about 1350-degree C molten iron could carry out the knowledge of a reaction hardly advancing. This invention is made based on this knowledge. That is, in the case of this invention, the big problem of bumping which considered generating of CO gas by reduction of a rapid iron oxide which occurs when molten iron is \*\*\*\*(ed) to the slag generated by plain steel decarbonization refinement as the cause does not arise at all, but for this reason, in the furnace which remained the generation slag of front charge, where reaction control is carried out, it can insert in molten iron.

[0013] Cr<sub>2</sub>O<sub>3</sub> The conditions for making quick reduction speed of the chromium from a content slag That the reaction interface product between a slag/metal is large, i.e., maintain the rate of the liquid phase of a slag at a high order, and Cr<sub>2</sub>O<sub>3</sub> in a molten slag phase Cr<sub>2</sub>O<sub>3</sub> under keeping large the driving force of migration to a reduction reaction interface, i.e., a slag, Although it is that activity is high As shown in drawing 2 , it is Cr<sub>2</sub>O<sub>3</sub>. As opposed to the case where concentration is about 25% or more It is Cr<sub>2</sub>O<sub>3</sub> in a slag that it is 20% or less. Activity is Cr<sub>2</sub>O<sub>3</sub> in the molten slag phase which it becomes 1/2 or less, and is the driving force of a reaction. It will originate in the activity difference in activity and a reaction interface product becoming small, and the reactivity between a slag/metal will fall remarkably. this -- Cr<sub>2</sub>O<sub>3</sub> in a slag if concentration falls to 20% or less -- pure Cr<sub>2</sub>O<sub>3</sub> in solid phase disappearing -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is because formation of a multiple oxide serves as a subject. Therefore, Cr<sub>2</sub>O<sub>3</sub> When concentration is 20% or less, the reduction reaction of the chromium by molten iron hardly advances, but becomes avoidable [ generating of CO gas resulting from the rapid reduction reaction at the time of molten iron insertion, i.e., bumping, ].

[0014] However, if reduction of chromium does not advance in the \*\*\*\* reducing period after molten iron insertion (production process 3 in drawing 1 ), the fall of productivity etc. is caused and it is not practical. On the other hand, this invention persons are Cr<sub>2</sub>O<sub>3</sub>, if the temperature of both melted iron (molten iron and molten steel) and a slag is 1500 degrees C or more. Even when concentration was 20% or less, it discovered that a reduction reaction was promoted sharply. Drawing 3 is Cr<sub>2</sub>O<sub>3</sub>. Although it is the result of investigating the temperature dependence of the reduction reaction by the molten iron of a content slag, it is Cr<sub>2</sub>O<sub>3</sub>. Even when concentration is 20% or less, it turns out that reduction speed is increasing rapidly bordering on about 1500 degrees C. That is, since the temperature of the both sides immediately after molten iron insertion becomes that the temperature of insertion molten iron is 1500 degrees C or less, and slag temperature is 1700 degrees C or less with 1500 degrees C or less when the amount of survival in a furnace of the decarbonization slag which is usually operation within the limits is 100 to 500 (kg/ton-Pig) degree to the amount of insertion molten iron, bumping evasion will be possible.

[0015] Therefore, if this slag is made to coexist with molten iron and carries out a temperature up within a converter, after temperature rises, it is shown that the chromic-acid ghost in a slag is returned. The rate of the liquid phase of a slag improves remarkably that slag temperature is 1500 degrees C or more when 20Cr<sub>3</sub> concentration is 20% or less, the dissolution rate of the chromic-acid ghost to the inside of a molten slag phase becomes large, and this is Cr<sub>2</sub>O<sub>3</sub>. Since activity also rises, the reaction is promoted. However, as for a real operation top, in a hot case, the amount of erosions of refractories increases rapidly rather than 1700 degrees C.

[0016] Although evasion of bumping is possible, when productivity and the chromium yield are taken into consideration, in order for the reduction speed in a temperature-programmed-reduction production process to need to maintain to a high order as much as possible and to make this reduction condition

more advantageous in this invention, it is Cr<sub>2</sub>O<sub>3</sub>. Even if concentration is 20% or less, by control of a slag presentation, it is Cr<sub>2</sub>O<sub>3</sub> in a slag. It is necessary to maintain activity to a high order as much as possible. Reduction of the chromium from the slag which contains Cr<sub>2</sub>O<sub>3</sub> which generated this by decarbonization refinement of high chrome steel 25% or more is Cr<sub>2</sub>O<sub>3</sub> in a slag. Since activity is as high as 1, it says [ that a reaction rate is quick ], the chromic-acid ghost which exists in a slag - Cr<sub>2</sub>O<sub>3</sub> it is -- a sake -- easy -- the liquid phase -- inside -- it can dissolve -- since -- a macro --like -- the liquid phase -- a rate -- increasing -- not making -- \*\* -- reduction -- being possible -- \*\* -- saying -- the fact -- the thing based on discovery -- it is . That is, Cr<sub>2</sub>O<sub>3</sub> The slag to contain is Cr<sub>2</sub>O<sub>3</sub>. The minute solid phase used as the principal component In order to be in the condition which exists innumerable in the liquid (molten slag phase) constituted with other oxides and to maintain the reduction speed of chromium to a high order setting solid phase to pure Cr<sub>2</sub>O<sub>3</sub> -- if it puts in another way -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is indispensable to hold a slag presentation on the conditions which are not formed as much as possible.

[0017] Among these, MgO-Cr<sub>2</sub>O<sub>3</sub> It is a principal component in a chrome ore, and when MgO concentration is too high also in decarbonization slag, in order to generate, it is necessary to make MgO concentration in decarbonization slag 15% or less. On the other hand, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is CaO/SiO<sub>2</sub> in order to generate, when the CaO concentration in a slag is too high. It is necessary to carry out to 3.0 or less. However, CaO/SiO<sub>2</sub> When it is the range of 3.0-4.0, it is aluminum 2O<sub>3</sub>. By controlling concentration in 5 - 20% of range, it is CaO-aluminum 2O<sub>3</sub>. In order to form the compound of a system, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is possible to minimum-ize formation. However, CaO/SiO<sub>2</sub> Even if it is 3.0 or less, it is aluminum 2O<sub>3</sub>. The case where concentration is less than 5%, and CaO/SiO<sub>2</sub> 4.0 super-\*\*\*\*\* and 20% or less of aluminum 2O<sub>3</sub>, at concentration, it is CaO-aluminum 2O<sub>3</sub>. Since it is inadequate for formation of a system compound, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. Formation will be promoted. Moreover, CaO/SiO<sub>2</sub> The case where it is less than 1.0, and aluminum 2O<sub>3</sub> When concentration is 20% \*\*, since MgO solubility increases, a refractories erosion increases and is not practical.

[0018] Moreover, since the slag of each above-mentioned presentation has high viscosity, it does not add charcoal material superfluously but has the feature, SUROPPINGU [ \*\* ]. Therefore, it becomes possible to return blowing a top and advancing decarbonization of a steel bath by oxygen. By carrying out like this, since the total amount of decarbonization which let the reducing period and the decarbonization term pass decreases, productivity can be raised sharply. Although drawing 4 shows the relation between carbon concentration and reduction speed, by controlling a slag presentation on the above-mentioned conditions shows that there is sufficient reducing power, if carbon concentration is 1% or more.

[0019] By the way, it is necessary to carry out efficiently as much as possible from a viewpoint of productivity also with reduction by charcoal material addition of the decarbonization slag after tapping. Although it is fully securing a slag / charcoal material interface product as this condition by performing the furnace swing of multiple times after adding charcoal material in a converter, and securing sufficient temperature blowing a top and performing a reduction reaction by combustion of the charcoal material by \*\*\*\* Charcoal material reduction is performed [ that is, ] at an elevated temperature from 1700 degrees C. The slag temperature at the time of molten iron insertion to a 1700-degree-C super-\*\*\*\*\* case Reduction speed is Cr<sub>2</sub>O<sub>3</sub> even if, although a high order is maintainable. Even if it reduces concentration to 20% or less, since a local elevated-temperature portion exists at the time of molten iron insertion of degree production process, and bumping may be caused and the amount of erosions of refractories also increases, it is not practical. Conversely, if slag cooling is performed for bumping evasion, since a cooldown delay is needed, a failure will be produced for productivity. Moreover, the problem that the reduction speed itself becomes it late that the slag temperature at the time of molten iron insertion is less than 1400 degrees C will arise. Therefore, it is necessary to perform charcoal material reduction of the decarbonization slag after tapping in 1400-1700 degrees C. In addition, since between a slag/melted iron can serve as a reaction interface by making the molten steel after charge-before 1000kg / (ton-Slag) following tapping remain in a furnace, and performing this charcoal material reduction in addition to between a slag / charcoal material, reduction speed improves by leaps and bounds. However, if the residual amount of molten steel exceeds 1000kg/(ton-Slag), since there is nothing ( drawing 5 ), the tapping yield falls to reverse and the improvement effect of the reduction speed beyond it produces a failure for productivity, it is hardly practical.

[0020] Furthermore, since the local elevated-temperature (1500 degrees C or more) portion between slag metal may be formed also about insertion molten iron temperature as the residual slag temperature in a furnace is 1400 degrees C or more when the temperature exceeds 1500 degrees C, the danger of bumping is nonavoidable.

[0021]

[Example] The production process of an example is the same as that of drawing 1. After adding charcoal material from on a furnace to the 175t raised bottom \*\*\*\* converter which left in the furnace the decarbonization slag generated by decarbonization of front charge and performing the furnace swing of multiple times to it, while inserting in the molten iron of degree charge, blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned (temperature-programmed-reduction term). Then, a converter is tilted, the waste of the slag of a part or most is carried out, and subsequently a furnace is uprighted, and oxygen is transmitted, adding a ferrochrome alloy and flux, and decarbonization refinement is carried out. After falling to the target carbon concentration, a furnace is tilted again, tapping only of the molten steel is carried out, and the slag containing a chromic-acid ghost is made to remain in a furnace. The molten steel which carried out tapping moves to a finish decarbonization production process, and it adds charcoal material from on a furnace to a converter, with a slag left. Here, a scrap may be used for the case where charcoal material and flux are used for a temperature-programmed-reduction term depending on thermal conditions or slag conditions, a temperature-programmed-reduction term, or an decarbonization term.

[0022] The example of the charcoal material reduction in this invention is shown in a table 1 with the example of a comparison. Test numbers 1-6 are the examples of this invention. On the other hand, although a test number 7 is the case that the slag temperature at the time of molten iron insertion is high, generating of bumping is seen and the erosion of refractories is also great. Moreover, heat retaining temperature is low, charcoal material reduction is inadequate, and a test number 8 is Cr 2O3. Although it is the case that concentration is high, although generating of bumping does not take place that insertion molten iron temperature is 1500 degrees C or less in this case, a subsequent temperature-programmed-reduction production process takes time amount, and a problem is produced for productivity. Furthermore, although a test number 9 and a test number 10 are the cases that insertion molten iron temperature is high, bumping has all occurred in these cases. Moreover, although a furnace swing is not performed although the heat retaining temperature of test numbers 11 and 12 is enough, but it is the case which was inadequate Slag temperature is high, and when the temperature of both a slag and molten iron after molten iron insertion exceeds 1500 degrees C, bumping occurs, and in the case where it is 1500 degrees C or less, in order to originate in reduction having not advanced at a charcoal material reducing period and for a subsequent \*\*\*\* reducing period to take a long time, a problem is produced for productivity.

[0023]

[A table 1]

[0024] What clarified efficient conditions more at the temperature-programmed-reduction term of this invention shown in drawing 1 is combined with the example of a comparison, and a table 2 shows it. Test numbers 13-21 correspond to the desirable conditions in the example of this invention. On the other hand, although 22 and 23 of a test number are the case where the basicity in decarbonization slag (CaO/SiO2) is low, and a high case, and it is satisfactory to the reduction itself in being low, since the solubility of MgO to the inside of a slag increases, the amount of refractories erosions increases. Conversely, when high, the solid phase in a slag is CaO-Cr 2O3. Since it becomes, it is Cr 2O3. Activity falls, and reduction speed does not improve but it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. Moreover, a test number 24 is aluminum 2O3. Although it is the case that concentration is high, and it is satisfactory to the reduction itself also in this case, increase of the amount of refractories erosions poses a problem. Furthermore, for a test number 25, although it is the case that MgO concentration is high, the solid phase in a slag is MgO-Cr 2O3 also in this case. Since it becomes, it is Cr 2O3. Activity falls, and since reduction speed is low, it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. On the other hand, although it is the case where test numbers 26 and 27 have a high temperature at the time of temperature-programmed-reduction term termination, and a low case, and it is satisfactory to the reduction itself in being high, the amount of refractories erosions increases

remarkably. Conversely, since it originates in decline in the rate of the liquid phase of a slag and reactivity is checked when low, it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. Concentration becomes high. Moreover, although a test number 28 is the case where the carbon concentration in melted iron is 1% or less, it originates in the fall of reduction speed, and it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. It becomes high.

[0025]

[A table 2]

[0026]

[Effect of the Invention] Refinement of the efficient stainless steel which does not use an expensive reducing agent at all was attained without making a refractories erosion increase without causing bumping by using the decarbonization slag of front charge for blowing of degree charge in refinement with a converter mold reaction container by this invention.

[Claim(s)]

[Claim 1] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 2] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace By making chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag into 20% or less, and spraying oxygen Burn charcoal material, and where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 3] A manufacture method of stainless steel rough molten steel using decarbonization slag according to claim 1 or 2 characterized by making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping.

[Claim 4] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. A manufacture method of stainless steel rough molten steel using 1.0-3.0, and decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less.

[Claim 5] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. 3.0-4.0, and aluminum 2O<sub>3</sub> A manufacture method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less 5 to 20%.

[Claim 6] \*\*\*\* temperature up refinement is the ingot method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-5 characterized by carrying out controlling molten steel temperature at 1500-1700 degrees C where carbon concentration is made into 1% or more.

## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### [0001]

[Industrial Application] It is related with the manufacture method of the stainless steel rough molten steel characterized by carrying out the waste of the slag collected [chromium], and carrying out decarbonization refinement at the same furnace successively after this invention returns a part for the chrome oxide in the decarbonization slag generated by front charge in refinement with a converter mold reaction container with the molten iron of degree charge.

#### [0002]

[Description of the Prior Art] There is \*\* chromium melted iron ingot with the electric furnace as a raw material for refining the molten steel containing chromium using the shaft furnace molten iron dephosphorized and desulfurized by refinement furnace outside, the \*\* chromium molten iron generated by melting reduction of a chrome ore, and a stainless steel scrap. These raw materials are falling to the carbon concentration which fulfills a quality-of-the-material property by carrying out \*\*\*\* decarbonization refinement by the top-blown rotary converter, the \*\*\*\*\* converter, the raised bottom \*\*\*\* converter, and AOD, and carrying out \*\*\*\* decarbonization refinement at VOD or a vacuum-refining furnace called RH-alumnus further depending on the case.

[0003] However, in these refinement furnaces, carrying out reduction recovery of the chrome oxide generated during \*\*\*\* decarbonization at the time of \*\*\*\* termination using reducing agents, such as Fe-Si, is performed widely. Since this reducing agent has the high price, the attempt for which chromic-acid-ization in \*\*\*\* is reduced as much as possible is made. For example, at JP,61-3815,A or JP,61-19716,A, the refinement method which controlled oxidation of chromium is indicated by controlling the oxygen transmission speed and the stirring force under blowing proper. However, even if it uses these methods, the amount of the reducing agent used cannot be made into zero.

[0004] On the other hand, with the plain steel which does not contain chromium, the method of using the slag generated by decarbonization as a dephosphorization agent of the molten iron removal treatment of phosphorus performed with a converter mold reaction container is shown by JP,63-195209,A. however, the oxide generated by decarbonization refinement of high chrome steel to being effective as a dephosphorization agent since FeO generated by decarbonization refinement of plain steel is easily returned with the carbon in molten iron even if it is low temperature -- Cr 2O3 of difficulty reducibility A sake it is -- Cr 2O3 In the state of low temperature, even if it was molten iron of the concentration near carbon saturation, it could not return, but there was a problem that it could not use as a dephosphorization agent. Moreover, since the so-called bumping in which the generating reaction of explosive CO gas arises and insertion molten iron disperses at the time of molten iron insertion since reactivity is good happened, the high slag of FeO had a problem on safety.

[0005] By the way, when dephosphorization is carried out by refinement furnace outside and it aims only at reduction of a chromic-acid ghost, it is equivalent to the melting reduction technology in the converter mold reaction container of a chromic-acid ghost, and such technology is shown by JP,60-9815,A and JP,1-215913,A. This method adds a chrome ore and charcoal material continuously under the conditions controlled to the specific slag presentation. However, in order [ that the chromic-acid ghost concentration contained in a slag is very low as compared with decarbonization slag, and the fluidity of a slag is high and in order to use a lot of charcoal material for reduction ], Molten iron had the feature that carbon runs at speed also with the quick reduction by near and molten iron to saturated concentration, and reduction on the conditions in which it is the carbon partial saturation in the slag condition which does not have a fluidity highly [ chromic-acid ghost concentration ], and the charcoal material in a slag does not exist had the problem that it could not do, with this technology.

[0006] Moreover, as the recovery use method of the chromium from \*\* chrome steel slag, the cooling solidification of the remnants of \*\* chrome steel is carried out, and the method of adding solid-state remnants at the time of blowing of other charges for \*\* chrome steel in a converter is shown by JP,53-119210,A. However, since the cooling solidification of the remnants of \*\* chrome steel is carried out, although bumping at the time of molten iron insertion is avoidable by this method In order for a reaction to hardly have advanced at the time of low temperature, but to have advanced the reduction reaction and to have collected parts for the chromium of the amount of aims, molten iron temperature

and slag temperature needed to be raised to a certain amount of temperature, and there was a problem of having originated in this and causing extension of remarkable refinement time amount, i.e., the fall of productivity.

[0007]

[Problem(s) to be Solved by the Invention] The problem that this invention cannot make zero the expensive amount of the reducing agent used with the technology indicated by JP,61-3815,A and JP,61-19716,A, With the technology currently indicated by JP,63-195209,A The oxide which the problem on the safety of bumping is upwards, and is generated by decarbonization refinement of high chrome steel Cr 2O3 of difficulty reducibility it is -- a sake -- molten iron -- easy -- returning -- not having -- as a dephosphorization agent -- it cannot use -- \*\* -- saying -- a problem -- and by the method currently indicated by JP,60-9815,A or JP,1-215913,A Chromic-acid ghost concentration by the carbon partial saturation in the slag condition which does not have a fluidity highly And the problem that reduction on the conditions to which charcoal material does not exist in a slag cannot be performed, By the method furthermore shown by JP,53-119210,A, the problem of causing extension of remarkable blowing time amount is solved, and it aims at offering the manufacture method of stainless steel rough molten steel using efficient decarbonization slag.

[0008]

[Means for Solving the Problem] A place which this invention solves said technical problem and is made into the summary By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr 2O3) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge with a temperature of 1500 degrees C or less is inserted in. After carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag, the waste of the slag collected [ chromium ] is carried out, and it is in a manufacture method of stainless steel rough molten steel using decarbonization slag characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly.

[0009] When long duration is taken to insert in molten iron of degree charge here and temperature of decarbonization slag falls to less than 1400 degrees C, it is effective by blowing a top after charcoal material addition, performing \*\*\*\*, and burning charcoal material to hold temperature of decarbonization slag before molten iron insertion at 1400-1700 degrees C. Moreover, while making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO2. [ whether 1.0-3.0, and MgO are 15% or less and ] Or CaO/SiO2 3.0-4.0, and aluminum 2O3 5 - 20% and MgO being 15% or less and \*\*\*\* temperature up refinement are in a condition which made carbon concentration in molten steel 1% or more. By carrying out controlling molten steel temperature at 1500-1700 degrees C, the reduction recovery of the part for chromium in decarbonization slag can be carried out much more efficiently.

[0010] Furthermore, if the aforementioned slag heat retaining temperature is made into 1400-1500 degrees C, an erosion of refractories can be controlled completely, is stabilized more and can attain sufficient effect.

[0011]

[Function] The production process of this invention is shown in drawing 1 . the reduction production process according [ a production process 1 ] to the charcoal material addition after tapping -- a production process 2 -- the insertion production process to the converter of dephosphorization / desulfurization molten iron -- a production process 3 -- a temperature-programmed-reduction production process -- in a production process 4, a production process 5 shows the dissolution production process of decarbonization and a ferrochrome alloy, and a production process 6 shows a tapping production process for a middle waste production process. For the slag after charcoal material reduction termination, and 3, as for a converter and 5, in drawing 1 , melted iron (molten iron thru/molten steel) and 4 are [ the decarbonization slag which generated 1 by front charge and 2 / the slag collected / chromium / and 6 ] decarbonization slag. Thus, by adding charcoal material, performing the furnace swing of multiple times, leaving in a converter the decarbonization slag generated by decarbonization of front charge, and mixing charcoal material with decarbonization slag The

temperature of decarbonization slag in the condition of having held at 1400-1700 degrees C, by reducing the chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag to 20% or less, and blowing oxygen a top, carrying out it, and burning charcoal material The molten iron of degree charge of 1500 degrees C or less is inserted in, and while blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned. Then, after tilting a converter and carrying out the waste of this chromium recovery part slag, while uprighting a furnace and being decarbonized by blowing oxygen a top and carrying out it, it is the production process which carries out addition dissolution of the ferrochrome alloy, and manufactures stainless steel rough molten steel. In addition, the converter mold reaction container as used in the field of this invention has pointed out the reaction container which makes a refinement means blowing by the oxidizing gas represented by a top-blown rotary converter and the raised bottom \*\*\*\* converter.

[0012] this invention persons are Cr<sub>2</sub>O<sub>3</sub>. As a result of considering wholeheartedly the reaction of a content slag and carbon saturation melted iron, it is Cr<sub>2</sub>O<sub>3</sub>. Even if the temperature of a content slag is 1400 degrees C or more and it has a fluidity, it is Cr<sub>2</sub>O<sub>3</sub>. By reducing concentration to 20% or less, about 1350-degree C molten iron could carry out the knowledge of a reaction hardly advancing. This invention is made based on this knowledge. That is, in the case of this invention, the big problem of bumping which considered generating of CO gas by reduction of a rapid iron oxide which occurs when molten iron is \*\*\*\*(ed) to the slag generated by plain steel decarbonization refinement as the cause does not arise at all, but for this reason, in the furnace which remained the generation slag of front charge, where reaction control is carried out, it can insert in molten iron.

[0013] Cr<sub>2</sub>O<sub>3</sub> The conditions for making quick reduction speed of the chromium from a content slag That the reaction interface product between a slag/metal is large, i.e., maintain the rate of the liquid phase of a slag at a high order, and Cr<sub>2</sub>O<sub>3</sub> in a molten slag phase Cr<sub>2</sub>O<sub>3</sub> under keeping large the driving force of migration to a reduction reaction interface, i.e., a slag, Although it is that activity is high As shown in drawing 2, it is Cr<sub>2</sub>O<sub>3</sub>. As opposed to the case where concentration is about 25% or more It is Cr<sub>2</sub>O<sub>3</sub> in a slag that it is 20% or less. Activity is Cr<sub>2</sub>O<sub>3</sub> in the molten slag phase which it becomes 1/2 or less, and is the driving force of a reaction. It will originate in the activity difference in activity and a reaction interface product becoming small, and the reactivity between a slag/metal will fall remarkably. this -- Cr<sub>2</sub>O<sub>3</sub> in a slag if concentration falls to 20% or less -- pure Cr<sub>2</sub>O<sub>3</sub> in solid phase disappearing -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is because formation of a multiple oxide serves as a subject. Therefore, Cr<sub>2</sub>O<sub>3</sub> When concentration is 20% or less, the reduction reaction of the chromium by molten iron hardly advances, but becomes avoidable [ generating of CO gas resulting from the rapid reduction reaction at the time of molten iron insertion, i.e., bumping, ].

[0014] However, if reduction of chromium does not advance in the \*\*\*\* reducing period after molten iron insertion (production process 3 in drawing 1 ), the fall of productivity etc. is caused and it is not practical. On the other hand, this invention persons are Cr<sub>2</sub>O<sub>3</sub>, if the temperature of both melted iron (molten iron and molten steel) and a slag is 1500 degrees C or more. Even when concentration was 20% or less, it discovered that a reduction reaction was promoted sharply. Drawing 3 is Cr<sub>2</sub>O<sub>3</sub>. Although it is the result of investigating the temperature dependence of the reduction reaction by the molten iron of a content slag, it is Cr<sub>2</sub>O<sub>3</sub>. Even when concentration is 20% or less, it turns out that reduction speed is increasing rapidly bordering on about 1500 degrees C. That is, since the temperature of the both sides immediately after molten iron insertion becomes that the temperature of insertion molten iron is 1500 degrees C or less, and slag temperature is 1700 degrees C or less with 1500 degrees C or less when the amount of survival in a furnace of the decarbonization slag which is usually operation within the limits is 100 to 500 (kg/ton-Pig) degree to the amount of insertion molten iron, bumping evasion will be possible.

[0015] Therefore, if this slag is made to coexist with molten iron and carries out a temperature up within a converter, after temperature rises, it is shown that the chromic-acid ghost in a slag is returned. The rate of the liquid phase of a slag improves remarkably that slag temperature is 1500 degrees C or more when 20Cr<sub>3</sub> concentration is 20% or less, the dissolution rate of the chromic-acid ghost to the inside of a molten slag phase becomes large, and this is Cr<sub>2</sub>O<sub>3</sub>. Since activity also rises, the reaction is promoted. However, as for a real operation top, in a hot case, the amount of erosions of refractories increases rapidly rather than 1700 degrees C.

[0016] Although evasion of bumping is possible, when productivity and the chromium yield are taken into consideration, in order for the reduction speed in a temperature-programmed-reduction production process to need to maintain to a high order as much as possible and to make this reduction condition

more advantageous in this invention, it is Cr<sub>2</sub>O<sub>3</sub>. Even if concentration is 20% or less, by control of a slag presentation, it is Cr<sub>2</sub>O<sub>3</sub> in a slag. It is necessary to maintain activity to a high order as much as possible. Reduction of the chromium from the slag which contains Cr<sub>2</sub>O<sub>3</sub> which generated this by decarbonization refinement of high chrome steel 25% or more is Cr<sub>2</sub>O<sub>3</sub> in a slag. Since activity is as high as 1, it says [ that a reaction rate is quick ], the chromic-acid ghost which exists in a slag -- Cr<sub>2</sub>O<sub>3</sub> it is -- a sake -- easy -- the liquid phase -- inside -- it can dissolve -- since -- a macro --like -- the liquid phase -- a rate -- increasing -- not making -- \*\* -- reduction -- being possible -- \*\* -- saying -- the fact -- the thing based on discovery -- it is . That is, Cr<sub>2</sub>O<sub>3</sub> The slag to contain is Cr<sub>2</sub>O<sub>3</sub>. The minute solid phase used as the principal component In order to be in the condition which exists innumerable in the liquid (molten slag phase) constituted with other oxides and to maintain the reduction speed of chromium to a high order setting solid phase to pure Cr<sub>2</sub>O<sub>3</sub> -- if it puts in another way -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is indispensable to hold a slag presentation on the conditions which are not formed as much as possible.

[0017] Among these, MgO-Cr<sub>2</sub>O<sub>3</sub> It is a principal component in a chrome ore, and when MgO concentration is too high also in decarbonization slag, in order to generate, it is necessary to make MgO concentration in decarbonization slag 15% or less. On the other hand, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is CaO/SiO<sub>2</sub> in order to generate, when the CaO concentration in a slag is too high. It is necessary to carry out to 3.0 or less. However, CaO/SiO<sub>2</sub> When it is the range of 3.0-4.0, it is aluminum 2O<sub>3</sub>. By controlling concentration in 5 - 20% of range, it is CaO-aluminum 2O<sub>3</sub>. In order to form the compound of a system, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is possible to minimum-ize formation. However, CaO/SiO<sub>2</sub> Even if it is 3.0 or less, it is aluminum 2O<sub>3</sub>. The case where concentration is less than 5%, and CaO/SiO<sub>2</sub> 4.0 super-\*\*\*\*\* and 20% or less of aluminum 2O<sub>3</sub>, at concentration, it is CaO-aluminum 2O<sub>3</sub>. Since it is inadequate for formation of a system compound, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. Formation will be promoted. Moreover, CaO/SiO<sub>2</sub> The case where it is less than 1.0, and aluminum 2O<sub>3</sub> When concentration is 20% \*\*, since MgO solubility increases, a refractories erosion increases and is not practical.

[0018] Moreover, since the slag of each above-mentioned presentation has high viscosity, it does not add charcoal material superfluously but has the feature, SUROPPINGU [ \*\* ]. Therefore, it becomes possible to return blowing a top and advancing decarbonization of a steel bath by oxygen. By carrying out like this, since the total amount of decarbonization which let the reducing period and the decarbonization term pass decreases, productivity can be raised sharply. Although drawing 4 shows the relation between carbon concentration and reduction speed, by controlling a slag presentation on the above-mentioned conditions shows that there is sufficient reducing power, if carbon concentration is 1% or more.

[0019] By the way, it is necessary to carry out efficiently as much as possible from a viewpoint of productivity also with reduction by charcoal material addition of the decarbonization slag after tapping. Although it is fully securing a slag / charcoal material interface product as this condition by performing the furnace swing of multiple times after adding charcoal material in a converter, and securing sufficient temperature blowing a top and performing a reduction reaction by combustion of the charcoal material by \*\*\*\* Charcoal material reduction is performed [ that is, ] at an elevated temperature from 1700 degrees C. The slag temperature at the time of molten iron insertion to a 1700-degree-C super-\*\*\*\*\* case Reduction speed is Cr<sub>2</sub>O<sub>3</sub> even if, although a high order is maintainable. Even if it reduces concentration to 20% or less, since a local elevated-temperature portion exists at the time of molten iron insertion of degree production process, and bumping may be caused and the amount of erosions of refractories also increases, it is not practical. Conversely, if slag cooling is performed for bumping evasion, since a cooldown delay is needed, a failure will be produced for productivity. Moreover, the problem that the reduction speed itself becomes it late that the slag temperature at the time of molten iron insertion is less than 1400 degrees C will arise. Therefore, it is necessary to perform charcoal material reduction of the decarbonization slag after tapping in 1400-1700 degrees C. In addition, since between a slag/melted iron can serve as a reaction interface by making the molten steel after charge-before 1000kg / (ton-Slag) following tapping remain in a furnace, and performing this charcoal material reduction in addition to between a slag / charcoal material, reduction speed improves by leaps and bounds. However, if the residual amount of molten steel exceeds 1000kg/(ton-Slag), since there is nothing ( drawing 5 ), the tapping yield falls to reverse and the improvement effect of the reduction speed beyond it produces a failure for productivity, it is hardly practical.

[0020] Furthermore, since the local elevated-temperature (1500 degrees C or more) portion between slag metal may be formed also about insertion molten iron temperature as the residual slag temperature in a furnace is 1400 degrees C or more when the temperature exceeds 1500 degrees C, the danger of bumping is nonavoidable.

[0021]

[Example] The production process of an example is the same as that of drawing 1. After adding charcoal material from on a furnace to the 175t raised bottom \*\*\*\* converter which left in the furnace the decarbonization slag generated by decarbonization of front charge and performing the furnace swing of multiple times to it, while inserting in the molten iron of degree charge, blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned (temperature-programmed-reduction term). Then, a converter is tilted, the waste of the slag of a part or most is carried out, and subsequently a furnace is uprighted, and oxygen is transmitted, adding a ferrochrome alloy and flux, and decarbonization refinement is carried out. After falling to the target carbon concentration, a furnace is tilted again, tapping only of the molten steel is carried out, and the slag containing a chromic-acid ghost is made to remain in a furnace. The molten steel which carried out tapping moves to a finish decarbonization production process, and it adds charcoal material from on a furnace to a converter, with a slag left. Here, a scrap may be used for the case where charcoal material and flux are used for a temperature-programmed-reduction term depending on thermal conditions or slag conditions, a temperature-programmed-reduction term, or an decarbonization term.

[0022] The example of the charcoal material reduction in this invention is shown in a table 1 with the example of a comparison. Test numbers 1-6 are the examples of this invention. On the other hand, although a test number 7 is the case that the slag temperature at the time of molten iron insertion is high, generating of bumping is seen and the erosion of refractories is also great. Moreover, heat retaining temperature is low, charcoal material reduction is inadequate, and a test number 8 is Cr 2O3. Although it is the case that concentration is high, although generating of bumping does not take place that insertion molten iron temperature is 1500 degrees C or less in this case, a subsequent temperature-programmed-reduction production process takes time amount, and a problem is produced for productivity. Furthermore, although a test number 9 and a test number 10 are the cases that insertion molten iron temperature is high, bumping has all occurred in these cases. Moreover, although a furnace swing is not performed although the heat retaining temperature of test numbers 11 and 12 is enough, but it is the case which was inadequate Slag temperature is high, and when the temperature of both a slag and molten iron after molten iron insertion exceeds 1500 degrees C, bumping occurs, and in the case where it is 1500 degrees C or less, in order to originate in reduction having not advanced at a charcoal material reducing period and for a subsequent \*\*\*\* reducing period to take a long time, a problem is produced for productivity.

[0023]

[A table 1]

[0024] What clarified efficient conditions more at the temperature-programmed-reduction term of this invention shown in drawing 1 is combined with the example of a comparison, and a table 2 shows it. Test numbers 13-21 correspond to the desirable conditions in the example of this invention. On the other hand, although 22 and 23 of a test number are the case where the basicity in decarbonization slag (CaO/SiO2) is low, and a high case, and it is satisfactory to the reduction itself in being low, since the solubility of MgO to the inside of a slag increases, the amount of refractories erosions increases. Conversely, when high, the solid phase in a slag is CaO-Cr 2O3. Since it becomes, it is Cr 2O3. Activity falls, and reduction speed does not improve but it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. Moreover, a test number 24 is aluminum 2O3. Although it is the case that concentration is high, and it is satisfactory to the reduction itself also in this case, increase of the amount of refractories erosions poses a problem. Furthermore, for a test number 25, although it is the case that MgO concentration is high, the solid phase in a slag is MgO-Cr 2O3 also in this case. Since it becomes, it is Cr 2O3. Activity falls, and since reduction speed is low, it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. On the other hand, although it is the case where test numbers 26 and 27 have a high temperature at the time of temperature-programmed-reduction term termination, and a low case, and it is satisfactory to the reduction itself in being high, the amount of refractories erosions increases

remarkably. Conversely, since it originates in decline in the rate of the liquid phase of a slag and reactivity is checked when low, it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. Concentration becomes high. Moreover, although a test number 28 is the case where the carbon concentration in melted iron is 1% or less, it originates in the fall of reduction speed, and it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. It becomes high.

[0025]

[A table 2]

[0026]

[Effect of the Invention] Refinement of the efficient stainless steel which does not use an expensive reducing agent at all was attained without making a refractories erosion increase without causing bumping by using the decarbonization slag of front charge for blowing of degree charge in refinement with a converter mold reaction container by this invention.

[Claim(s)]

[Claim 1] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 2] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace By making chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag into 20% or less, and spraying oxygen Burn charcoal material, and where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 3] A manufacture method of stainless steel rough molten steel using decarbonization slag according to claim 1 or 2 characterized by making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping.

[Claim 4] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. A manufacture method of stainless steel rough molten steel using 1.0-3.0, and decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less.

[Claim 5] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. 3.0-4.0, and aluminum 2O<sub>3</sub> A manufacture method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less 5 to 20%.

[Claim 6] \*\*\*\* temperature up refinement is the ingot method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-5 characterized by carrying out controlling molten steel temperature at 1500-1700 degrees C where carbon concentration is made into 1% or more.

## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Industrial Application] It is related with the manufacture method of the stainless steel rough molten steel characterized by carrying out the waste of the slag collected [chromium], and carrying out decarbonization refinement at the same furnace successively after this invention returns a part for the chrome oxide in the decarbonization slag generated by front charge in refinement with a converter mold reaction container with the molten iron of degree charge.

[0002]

[Description of the Prior Art] There is \*\* chromium melted iron ingoted with the electric furnace as a raw material for refining the molten steel containing chromium using the shaft furnace molten iron dephosphorized and desulfurized by refinement furnace outside, the \*\* chromium molten iron generated by melting reduction of a chrome ore, and a stainless steel scrap. These raw materials are falling to the carbon concentration which fulfills a quality-of-the-material property by carrying out \*\*\*\* decarbonization refinement by the top-blown rotary converter, the \*\*\*\*\* converter, the raised bottom \*\*\*\* converter, and AOD, and carrying out \*\*\*\* decarbonization refinement at VOD or a vacuum-refining furnace called RH-alumnus further depending on the case.

[0003] However, in these refinement furnaces, carrying out reduction recovery of the chrome oxide generated during \*\*\*\* decarbonization at the time of \*\*\*\* termination using reducing agents, such as Fe-Si, is performed widely. Since this reducing agent has the high price, the attempt for which chromic-acid-ization in \*\*\*\* is reduced as much as possible is made. For example, at JP,61-3815,A or JP,61-19716,A, the refinement method which controlled oxidation of chromium is indicated by controlling the oxygen transmission speed and the stirring force under blowing proper. However, even if it uses these methods, the amount of the reducing agent used cannot be made into zero.

[0004] On the other hand, with the plain steel which does not contain chromium, the method of using the slag generated by decarbonization as a dephosphorization agent of the molten iron removal treatment of phosphorus performed with a converter mold reaction container is shown by JP,63-195209,A. however, the oxide generated by decarbonization refinement of high chrome steel to being effective as a dephosphorization agent since FeO generated by decarbonization refinement of plain steel is easily returned with the carbon in molten iron even if it is low temperature -- Cr 2O3 of difficulty reducibility A sake it is -- Cr 2O3 In the state of low temperature, even if it was molten iron of the concentration near carbon saturation, it could not return, but there was a problem that it could not use as a dephosphorization agent. Moreover, since the so-called bumping in which the generating reaction of explosive CO gas arises and insertion molten iron disperses at the time of molten iron insertion since reactivity is good happened, the high slag of FeO had a problem on safety.

[0005] By the way, when dephosphorization is carried out by refinement furnace outside and it aims only at reduction of a chromic-acid ghost, it is equivalent to the melting reduction technology in the converter mold reaction container of a chromic-acid ghost, and such technology is shown by JP,60-9815,A and JP,1-215913,A. This method adds a chrome ore and charcoal material continuously under the conditions controlled to the specific slag presentation. However, in order [ that the chromic-acid ghost concentration contained in a slag is very low as compared with decarbonization slag, and the fluidity of a slag is high and in order to use a lot of charcoal material for reduction ], Molten iron had the feature that carbon runs at speed also with the quick reduction by near and molten iron to saturated concentration, and reduction on the conditions in which it is the carbon partial saturation in the slag condition which does not have a fluidity highly [ chromic-acid ghost concentration ], and the charcoal material in a slag does not exist had the problem that it could not do, with this technology.

[0006] Moreover, as the recovery use method of the chromium from \*\* chrome steel slag, the cooling solidification of the remnants of \*\* chrome steel is carried out, and the method of adding solid-state remnants at the time of blowing of other charges for \*\* chrome steel in a converter is shown by JP,53-119210,A. However, since the cooling solidification of the remnants of \*\* chrome steel is carried out, although bumping at the time of molten iron insertion is avoidable by this method In order for a reaction to hardly have advanced at the time of low temperature, but to have advanced the reduction reaction and to have collected parts for the chromium of the amount of aims, molten iron temperature

and slag temperature needed to be raised to a certain amount of temperature, and there was a problem of having originated in this and causing extension of remarkable refinement time amount, i.e., the fall of productivity.

[0007]

[Problem(s) to be Solved by the Invention] The problem that this invention cannot make zero the expensive amount of the reducing agent used with the technology indicated by JP,61-3815,A and JP,61-19716,A, With the technology currently indicated by JP,63-195209,A The oxide which the problem on the safety of bumping is upwards, and is generated by decarbonization refinement of high chrome steel Cr 2O3 of difficulty reducibility it is -- a sake -- molten iron -- easy -- returning -- not having -- as a dephosphorization agent -- it cannot use -- \*\* -- saying -- a problem -- and by the method currently indicated by JP,60-9815,A or JP,1-215913,A Chromic-acid ghost concentration by the carbon partial saturation in the slag condition which does not have a fluidity highly And the problem that reduction on the conditions to which charcoal material does not exist in a slag cannot be performed, By the method furthermore shown by JP,53-119210,A, the problem of causing extension of remarkable blowing time amount is solved, and it aims at offering the manufacture method of stainless steel rough molten steel using efficient decarbonization slag.

[0008]

[Means for Solving the Problem] A place which this invention solves said technical problem and is made into the summary By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr 2O3) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge with a temperature of 1500 degrees C or less is inserted in. After carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag, the waste of the slag collected [ chromium ] is carried out, and it is in a manufacture method of stainless steel rough molten steel using decarbonization slag characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly.

[0009] When long duration is taken to insert in molten iron of degree charge here and temperature of decarbonization slag falls to less than 1400 degrees C, it is effective by blowing a top after charcoal material addition, performing \*\*\*\*, and burning charcoal material to hold temperature of decarbonization slag before molten iron insertion at 1400-1700 degrees C. Moreover, while making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO2. [ whether 1.0-3.0, and MgO are 15% or less and ] Or CaO/SiO2 3.0-4.0, and aluminum 2O3 5 - 20% and MgO being 15% or less and \*\*\*\* temperature up refinement are in a condition which made carbon concentration in molten steel 1% or more. By carrying out controlling molten steel temperature at 1500-1700 degrees C, the reduction recovery of the part for chromium in decarbonization slag can be carried out much more efficiently.

[0010] Furthermore, if the aforementioned slag heat retaining temperature is made into 1400-1500 degrees C, an erosion of refractories can be controlled completely, is stabilized more and can attain sufficient effect.

[0011]

[Function] The production process of this invention is shown in drawing 1 . the reduction production process according [ a production process 1 ] to the charcoal material addition after tapping -- a production process 2 -- the insertion production process to the converter of dephosphorization / desulfurization molten iron -- a production process 3 -- a temperature-programmed-reduction production process -- in a production process 4, a production process 5 shows the dissolution production process of decarbonization and a ferrochrome alloy, and a production process 6 shows a tapping production process for a middle waste production process. For the slag after charcoal material reduction termination, and 3, as for a converter and 5, in drawing 1 , melted iron (molten iron thru/or molten steel) and 4 are [ the decarbonization slag which generated 1 by front charge and 2 / the slag collected / chromium / and 6 ] decarbonization slag. Thus, by adding charcoal material, performing the furnace swing of multiple times, leaving in a converter the decarbonization slag generated by decarbonization of front charge, and mixing charcoal material with decarbonization slag The

temperature of decarbonization slag in the condition of having held at 1400-1700 degrees C, by reducing the chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag to 20% or less, and blowing oxygen a top, carrying out it, and burning charcoal material The molten iron of degree charge of 1500 degrees C or less is inserted in, and while blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned. Then, after tilting a converter and carrying out the waste of this chromium recovery part slag, while uprighting a furnace and being decarbonized by blowing oxygen a top and carrying out it, it is the production process which carries out addition dissolution of the ferrochrome alloy, and manufactures stainless steel rough molten steel. In addition, the converter mold reaction container as used in the field of this invention has pointed out the reaction container which makes a refinement means blowing by the oxidizing gas represented by a top-blown rotary converter and the raised bottom \*\*\*\* converter.

[0012] this invention persons are Cr<sub>2</sub>O<sub>3</sub>. As a result of considering wholeheartedly the reaction of a content slag and carbon saturation melted iron, it is Cr<sub>2</sub>O<sub>3</sub>. Even if the temperature of a content slag is 1400 degrees C or more and it has a fluidity, it is Cr<sub>2</sub>O<sub>3</sub>. By reducing concentration to 20% or less, about 1350-degree C molten iron could carry out the knowledge of a reaction hardly advancing. This invention is made based on this knowledge. That is, in the case of this invention, the big problem of bumping which considered generating of CO gas by reduction of a rapid iron oxide which occurs when molten iron is \*\*\*\*(ed) to the slag generated by plain steel decarbonization refinement as the cause does not arise at all, but for this reason, in the furnace which remained the generation slag of front charge, where reaction control is carried out, it can insert in molten iron.

[0013] Cr<sub>2</sub>O<sub>3</sub> The conditions for making quick reduction speed of the chromium from a content slag That the reaction interface product between a slag/metal is large, i.e., maintain the rate of the liquid phase of a slag at a high order, and Cr<sub>2</sub>O<sub>3</sub> in a molten slag phase Cr<sub>2</sub>O<sub>3</sub> under keeping large the driving force of migration to a reduction reaction interface, i.e., a slag, Although it is that activity is high As shown in drawing 2, it is Cr<sub>2</sub>O<sub>3</sub>. As opposed to the case where concentration is about 25% or more It is Cr<sub>2</sub>O<sub>3</sub> in a slag that it is 20% or less. Activity is Cr<sub>2</sub>O<sub>3</sub> in the molten slag phase which it becomes 1/2 or less, and is the driving force of a reaction. It will originate in the activity difference in activity and a reaction interface product becoming small, and the reactivity between a slag/metal will fall remarkably. this -- Cr<sub>2</sub>O<sub>3</sub> in a slag if concentration falls to 20% or less -- pure Cr<sub>2</sub>O<sub>3</sub> in solid phase disappearing -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is because formation of a multiple oxide serves as a subject. Therefore, Cr<sub>2</sub>O<sub>3</sub> When concentration is 20% or less, the reduction reaction of the chromium by molten iron hardly advances, but becomes avoidable [ generating of CO gas resulting from the rapid reduction reaction at the time of molten iron insertion, i.e., bumping, ].

[0014] However, if reduction of chromium does not advance in the \*\*\*\* reducing period after molten iron insertion (production process 3 in drawing 1 ), the fall of productivity etc. is caused and it is not practical. On the other hand, this invention persons are Cr<sub>2</sub>O<sub>3</sub>, if the temperature of both melted iron (molten iron and molten steel) and a slag is 1500 degrees C or more. Even when concentration was 20% or less, it discovered that a reduction reaction was promoted sharply. Drawing 3 is Cr<sub>2</sub>O<sub>3</sub>. Although it is the result of investigating the temperature dependence of the reduction reaction by the molten iron of a content slag, it is Cr<sub>2</sub>O<sub>3</sub>. Even when concentration is 20% or less, it turns out that reduction speed is increasing rapidly bordering on about 1500 degrees C. That is, since the temperature of the both sides immediately after molten iron insertion becomes that the temperature of insertion molten iron is 1500 degrees C or less, and slag temperature is 1700 degrees C or less with 1500 degrees C or less when the amount of survival in a furnace of the decarbonization slag which is usually operation within the limits is 100 to 500 (kg/ton-Pig) degree to the amount of insertion molten iron, bumping evasion will be possible.

[0015] Therefore, if this slag is made to coexist with molten iron and carries out a temperature up within a converter, after temperature rises, it is shown that the chromic-acid ghost in a slag is returned. The rate of the liquid phase of a slag improves remarkably that slag temperature is 1500 degrees C or more when 20Cr<sub>3</sub> concentration is 20% or less, the dissolution rate of the chromic-acid ghost to the inside of a molten slag phase becomes large, and this is Cr<sub>2</sub>O<sub>3</sub>. Since activity also rises, the reaction is promoted. However, as for a real operation top, in a hot case, the amount of erosions of refractories increases rapidly rather than 1700 degrees C.

[0016] Although evasion of bumping is possible, when productivity and the chromium yield are taken into consideration, in order for the reduction speed in a temperature-programmed-reduction production process to need to maintain to a high order as much as possible and to make this reduction condition

more advantageous in this invention, it is Cr<sub>2</sub>O<sub>3</sub>. Even if concentration is 20% or less, by control of a slag presentation, it is Cr<sub>2</sub>O<sub>3</sub> in a slag. It is necessary to maintain activity to a high order as much as possible. Reduction of the chromium from the slag which contains Cr<sub>2</sub>O<sub>3</sub> which generated this by decarbonization refinement of high chrome steel 25% or more is Cr<sub>2</sub>O<sub>3</sub> in a slag. Since activity is as high as 1, it says [ that a reaction rate is quick ], the chromic-acid ghost which exists in a slag -- Cr<sub>2</sub>O<sub>3</sub> it is -- a sake -- easy -- the liquid phase -- inside -- it can dissolve -- since -- a macro --like -- the liquid phase -- a rate -- increasing -- not making -- \*\* -- reduction -- being possible -- \*\* -- saying -- the fact -- the thing based on discovery -- it is . That is, Cr<sub>2</sub>O<sub>3</sub> The slag to contain is Cr<sub>2</sub>O<sub>3</sub>. The minute solid phase used as the principal component In order to be in the condition which exists innumerable in the liquid (molten slag phase) constituted with other oxides and to maintain the reduction speed of chromium to a high order setting solid phase to pure Cr<sub>2</sub>O<sub>3</sub> -- if it puts in another way -- CaO-Cr<sub>2</sub>O<sub>3</sub> MgO-Cr<sub>2</sub>O<sub>3</sub> etc. -- it is indispensable to hold a slag presentation on the conditions which are not formed as much as possible.

[0017] Among these, MgO-Cr<sub>2</sub>O<sub>3</sub> It is a principal component in a chrome ore, and when MgO concentration is too high also in decarbonization slag, in order to generate, it is necessary to make MgO concentration in decarbonization slag 15% or less. On the other hand, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is CaO/SiO<sub>2</sub> in order to generate, when the CaO concentration in a slag is too high. It is necessary to carry out to 3.0 or less. However, CaO/SiO<sub>2</sub> When it is the range of 3.0-4.0, it is aluminum 2O<sub>3</sub>. By controlling concentration in 5 - 20% of range, it is CaO-aluminum 2O<sub>3</sub>. In order to form the compound of a system, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. It is possible to minimum-ize formation. However, CaO/SiO<sub>2</sub> Even if it is 3.0 or less, it is aluminum 2O<sub>3</sub>. The case where concentration is less than 5%, and CaO/SiO<sub>2</sub> 4.0 super-\*\*\*\*\* and 20% or less of aluminum 2O<sub>3</sub>, at concentration, it is CaO-aluminum 2O<sub>3</sub>. Since it is inadequate for formation of a system compound, it is CaO-Cr<sub>2</sub>O<sub>3</sub>. Formation will be promoted. Moreover, CaO/SiO<sub>2</sub> The case where it is less than 1.0, and aluminum 2O<sub>3</sub> When concentration is 20% \*\*, since MgO solubility increases, a refractories erosion increases and is not practical.

[0018] Moreover, since the slag of each above-mentioned presentation has high viscosity, it does not add charcoal material superfluously but has the feature, SUROPPINGU [ \*\* ]. Therefore, it becomes possible to return blowing a top and advancing decarbonization of a steel bath by oxygen. By carrying out like this, since the total amount of decarbonization which let the reducing period and the decarbonization term pass decreases, productivity can be raised sharply. Although drawing 4 shows the relation between carbon concentration and reduction speed, by controlling a slag presentation on the above-mentioned conditions shows that there is sufficient reducing power, if carbon concentration is 1% or more.

[0019] By the way, it is necessary to carry out efficiently as much as possible from a viewpoint of productivity also with reduction by charcoal material addition of the decarbonization slag after tapping. Although it is fully securing a slag / charcoal material interface product as this condition by performing the furnace swing of multiple times after adding charcoal material in a converter, and securing sufficient temperature blowing a top and performing a reduction reaction by combustion of the charcoal material by \*\*\*\* Charcoal material reduction is performed [ that is, ] at an elevated temperature from 1700 degrees C. The slag temperature at the time of molten iron insertion to a 1700-degree-C super-\*\*\*\*\* case Reduction speed is Cr<sub>2</sub>O<sub>3</sub> even if, although a high order is maintainable. Even if it reduces concentration to 20% or less, since a local elevated-temperature portion exists at the time of molten iron insertion of degree production process, and bumping may be caused and the amount of erosions of refractories also increases, it is not practical. Conversely, if slag cooling is performed for bumping evasion, since a cooldown delay is needed, a failure will be produced for productivity. Moreover, the problem that the reduction speed itself becomes it late that the slag temperature at the time of molten iron insertion is less than 1400 degrees C will arise. Therefore, it is necessary to perform charcoal material reduction of the decarbonization slag after tapping in 1400-1700 degrees C. In addition, since between a slag/melted iron can serve as a reaction interface by making the molten steel after charge-before 1000kg / (ton-Slag) following tapping remain in a furnace, and performing this charcoal material reduction in addition to between a slag / charcoal material, reduction speed improves by leaps and bounds. However, if the residual amount of molten steel exceeds 1000kg/(ton-Slag), since there is nothing ( drawing 5 ), the tapping yield falls to reverse and the improvement effect of the reduction speed beyond it produces a failure for productivity, it is hardly practical.

[0020] Furthermore, since the local elevated-temperature (1500 degrees C or more) portion between slag metal may be formed also about insertion molten iron temperature as the residual slag temperature in a furnace is 1400 degrees C or more when the temperature exceeds 1500 degrees C, the danger of bumping is nonavoidable.

[0021]

[Example] The production process of an example is the same as that of drawing 1 . After adding charcoal material from on a furnace to the 175t raised bottom \*\*\*\* converter which left in the furnace the decarbonization slag generated by decarbonization of front charge and performing the furnace swing of multiple times to it, while inserting in the molten iron of degree charge, blowing oxygen a top, carrying out it next and performing a temperature up, the chromic-acid ghost in decarbonization slag is returned (temperature-programmed-reduction term). Then, a converter is tilted, the waste of the slag of a part or most is carried out, and subsequently a furnace is uprighted, and oxygen is transmitted, adding a ferrochrome alloy and flux, and decarbonization refinement is carried out. After falling to the target carbon concentration, a furnace is tilted again, tapping only of the molten steel is carried out, and the slag containing a chromic-acid ghost is made to remain in a furnace. The molten steel which carried out tapping moves to a finish decarbonization production process, and it adds charcoal material from on a furnace to a converter, with a slag left. Here, a scrap may be used for the case where charcoal material and flux are used for a temperature-programmed-reduction term depending on thermal conditions or slag conditions, a temperature-programmed-reduction term, or an decarbonization term.

[0022] The example of the charcoal material reduction in this invention is shown in a table 1 with the example of a comparison. Test numbers 1-6 are the examples of this invention. On the other hand, although a test number 7 is the case that the slag temperature at the time of molten iron insertion is high, generating of bumping is seen and the erosion of refractories is also great. Moreover, heat retaining temperature is low, charcoal material reduction is inadequate, and a test number 8 is Cr 2O3. Although it is the case that concentration is high, although generating of bumping does not take place that insertion molten iron temperature is 1500 degrees C or less in this case, a subsequent temperature-programmed-reduction production process takes time amount, and a problem is produced for productivity. Furthermore, although a test number 9 and a test number 10 are the cases that insertion molten iron temperature is high, bumping has all occurred in these cases. Moreover, although a furnace swing is not performed although the heat retaining temperature of test numbers 11 and 12 is enough, but it is the case which was inadequate Slag temperature is high, and when the temperature of both a slag and molten iron after molten iron insertion exceeds 1500 degrees C, bumping occurs, and in the case where it is 1500 degrees C or less, in order to originate in reduction having not advanced at a charcoal material reducing period and for a subsequent \*\*\*\* reducing period to take a long time, a problem is produced for productivity.

[0023]

[A table 1]

[0024] What clarified efficient conditions more at the temperature-programmed-reduction term of this invention shown in drawing 1 is combined with the example of a comparison, and a table 2 shows it. Test numbers 13-21 correspond to the desirable conditions in the example of this invention. On the other hand, although 22 and 23 of a test number are the case where the basicity in decarbonization slag (CaO/SiO2) is low, and a high case, and it is satisfactory to the reduction itself in being low, since the solubility of MgO to the inside of a slag increases, the amount of refractories erosions increases. Conversely, when high, the solid phase in a slag is CaO-Cr 2O3. Since it becomes, it is Cr 2O3. Activity falls, and reduction speed does not improve but it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. Moreover, a test number 24 is aluminum 2O3. Although it is the case that concentration is high, and it is satisfactory to the reduction itself also in this case, increase of the amount of refractories erosions poses a problem. Furthermore, for a test number 25, although it is the case that MgO concentration is high, the solid phase in a slag is MgO-Cr 2O3 also in this case. Since it becomes, it is Cr 2O3. Activity falls, and since reduction speed is low, it is Cr 2O3 at the time of temperature-programmed-reduction term termination. Concentration becomes high. On the other hand, although it is the case where test numbers 26 and 27 have a high temperature at the time of temperature-programmed-reduction term termination, and a low case, and it is satisfactory to the reduction itself in being high, the amount of refractories erosions increases

remarkably. Conversely, since it originates in decline in the rate of the liquid phase of a slag and reactivity is checked when low, it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. Concentration becomes high. Moreover, although a test number 28 is the case where the carbon concentration in melted iron is 1% or less, it originates in the fall of reduction speed, and it is Cr<sub>2</sub>O<sub>3</sub> at the time of temperature-programmed-reduction termination. It becomes high.

[0025]

[A table 2]

[0026]

[Effect of the Invention] Refinement of the efficient stainless steel which does not use an expensive reducing agent at all was attained without making a refractories erosion increase without causing bumping by using the decarbonization slag of front charge for blowing of degree charge in refinement with a converter mold reaction container by this invention.

[Claim(s)]

[Claim 1] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace Chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag is made into 20% or less. And where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 2] By facing melted iron containing chromium carrying out decarbonization refinement with a converter mold reaction container, and supplying charcoal material in a furnace, while decarbonization slag containing a chromic-acid ghost generated by front charge had been made to remain in a furnace By making chromic-acid ghost (Cr<sub>2</sub>O<sub>3</sub>) concentration in decarbonization slag into 20% or less, and spraying oxygen Burn charcoal material, and where heat retaining of the temperature of decarbonization slag is carried out to 1400-1700 degrees C, molten iron of degree charge of 1500 degrees C or less is inserted in. A manufacture method of stainless steel rough molten steel using decarbonization slag which carries out the waste of the slag collected [ chromium ], and is characterized by performing decarbonization refinement, dissolving a ferrochrome alloy at the same furnace succeedingly after carrying out \*\*\*\* temperature up refinement and returning a part for chromium in said decarbonization slag.

[Claim 3] A manufacture method of stainless steel rough molten steel using decarbonization slag according to claim 1 or 2 characterized by making molten steel of 1000kg / (ton-Slag) following remain in a furnace to 1t (decarbonization slag) of generation slags after front charge tapping.

[Claim 4] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. A manufacture method of stainless steel rough molten steel using 1.0-3.0, and decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less.

[Claim 5] A component of decarbonization slag containing a chromic-acid ghost generated by front charge is CaO/SiO<sub>2</sub>. 3.0-4.0, and aluminum 2O<sub>3</sub> A manufacture method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-3 characterized by MgO being 15% or less 5 to 20%.

[Claim 6] \*\*\*\* temperature up refinement is the ingot method of stainless steel rough molten steel using decarbonization slag given in any 1 term of claims 1-5 characterized by carrying out controlling molten steel temperature at 1500-1700 degrees C where carbon concentration is made into 1% or more.

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